NATO Insensitive Munitions Information Center (NIMIC)

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By:

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This paper presents the history, organization, operation, assessment, and future of the NATO Insensitive Munitions Information Center *(Vugraphs 1 & 2).*

The conference of National Armament Directors (CNAD) of the North Atlantic Treaty Organization (NATO) recognized that a lack of an agreed assessment methodology for safety and suitability for service was a major impediment to increased interoperability of conventional munitions within the Alliance *(Vugraph 3).* To remove this impediment CNAD formed the Action Committee (AC)/310 in December 1979 as a tri-service cadre group. AC/310 is tasked to establish agreed international terminology, design principles, criteria, procedures and tests to cover all aspects of the assessment process for safety and suitability for service.

AC/310 was organized into four Sub Groups reporting to a Main Group *(Vugraph 4).* The Sub Groups are chartered to work on qualification of explosive materials (explosives, propellants and pyrotechnics); qualification of fuzing systems (including safe and arming devices for rocket motor ignition); the development of environmental tests (mechanical, climatic, chemical, and electrical); and qualification of the assembled munition system. The Main Group coordinates efforts within AC/310 and with other Groups within NATO.

In 1983, prompted by input from U.S. Representatives, AC/310 became aware of the emerging requirements of "Insensitive Munitions" (I.M.) programs *(Vugraph 5).* AC/310 recognized that these requirements should be considered an adjunct to the munitions safety program. The rationale for this being that safety and I.M. programs both deal with the survivability of munitions to environments, e.g. safety to those presented by the user in normal handling, storing, etc. evolutions as well as in reasonably forecast accident scenarios, while the I.M. program deals with munition survivability in the abnormal or combat induced environment. The very restrictive "acceptance" criteria which were being identified for I.M. related tests indicated to AC/310 that achieving the criteria would be virtually impossible without knowledge of appropriate technology to apply to the design. AC/310 considered that a Focal Point within NATO may be beneficial to advise munition developers of existing or emerging technologies to facilitate their efforts in meeting the new more stringent safety and I.M. requirements.

An Ad-Hoc Group was formed under AC/310 and entitled the "Restricted Editorial Working Group" (REWG) to determine if such a Focal Point was desireable, and if so where in NATO was a logical location *(Vugraph 6).* Based on a REWG report, AC/310 decided that such a Focal Point was desireable and that it was logical to be associated with AC/310. Since the NATO structure did not allow formation of another Sub Group another method of formation was required. An Information Exchange Working Party (IEWP) was formed to validate within NATO that the Focal Point was desired and to determine how it should be structured. To this aim a workshop was held in London in October 1986. During the workshop, technical presentations were given relative to a particular I.M. problem area, namely Sympathetic Detonation. Attendees were polled after the

three day session whether such information would be beneficial for the stated purpose of facilitating munition design to requirements. The attendees from government and industry of various NATO nations, as well as from various NATO groups, concluded a NATO Focal Point for information exchange would be of value. Accordingly, AC/310 decided to push forward with its efforts and formed an Information Center Working Group (ICWG) to establish the Focal Point.

The ICWG concluded that an immediate need existed for information exchange and that development of the Center warranted priority attention. It was therefore decided to form a Pilot NATO Insensitive Munitions Information Center (Pilot NIMIC) and a Memorandum of Understanding (MOU) was developed with the U.S. agreeing to act as the host nation.

In April of 1988 the MOU was signed by France, Netherlands, Norway, United Kingdom, and United States *(Vugraph 7)*. Canada signed an amendment one year later. The Pilot NIMIC became operational in Columbia, Maryland. The funds for salaries of the core staff of Program Manager, Information Specialist and Technician and a Secretary were provided by the host nation, as were funds for the operation of the physical plant. Other participating nations provided either technical specialists or funds. The Pilot phase was for a three year term concluding in April 1991.

The Pilot NIMIC operates under the provisions of its MOU which prescribes the daily management functions of the Center to be the responsibility of the Program Manager. The Program Manager is ultimately responsible to the Steering Committee for all matters. The Steering Committee is composed of a representative of each participating nation with an elected Chairman.

The MOU directed that Pilot NIMIC establish and validate an Information Analysis System and will *(Vugraph 8)*:

(a) Collect, store, and disseminate scientific and technical information on I.M.

(b) Provide and maintain a comprehensive data collection to facilitate design efforts for I.M. and minimize R&D efforts.

(c) Respond to technical inquiries by using the data base to analyze and generate recommended design approaches for I.M.

(d) Identify technology deficiencies that prevent requirements from being achieved and propose remedial actions.

(e) Analyze data and prepare data books and "state of the art" reports on I.M.

(f) Prepare for the transition to a permanent NIMIC at NATO Headquarters.

The above functions are to involve three major areas of concern namely *(Vugraphs 9 & 10)*:

(1) Combat Threats - Fragment impact, bullet impact, sympathetic detonation, fuel fire, etc.

(2) Explosives and Munitions - Rockets, missiles, bombs, torpedoes, fuzes, propellants, etc.

(3) Technical Areas - Ignition, thermal explosions, deflagration to detonation transition, mitigation devices, etc.

Pilot NIMIC realized, early on, that the I.M. concept was new, and that not all nations recognized the designation of I.M. (e.g. the U.K. preferred "low vulnerability" and the French "Munitions a Risques Attenues" (MURAT) *(Vugraph 11)*. Consequently, search strategies using the I.M. term even in the U.S. may prove fruitless. Nations were therefore requested to search their archives on safety.

Pilot NIMIC provided all nations with guidance in performing searches by identifying areas of interest in the "Pilot NIMIC Thesaurus" *(Vugraphs 12 & 12a)*.

Information has been received from participant searches of formal data bases such as the U.S. National Technical Information Service (NTIS), Defense Technical Information Center (DTIC); the U.K. Defence Research Information Center (DRIC); Canadian Defence Scientific Information Service (DSIS), the French CEDOCAR, and others *(Vugraph 13)*. Other inputs have been received from industrial and government agencies in all the participating nations, as well as from searches of the world patent index, chemical abstracts, etc.

Information is stored in two types: Hard copy and machine-readable and searchable. The former make use of a conventional file system in which the documents are identified and located by numerical sequence (NIMIC TR numbers). The machine-readable data is in a text-based data base (Bibliographic Retrieval Services (BRS) search format on a hard disc backed up on magnetic tapes. A multi-user version of BRS is used for searching the data bases. The most efficient and rapid method for entering data is to receive it in machine-readable form such as a floppy disc, or directly from a national information storage system. Some reformatting is usually required but significant time in abstracting and manual input efforts are saved.

The Pilot NIMIC maintains seven data bases *(Vugraph 14)*. The major ones being the NIMIC Information Data Base (NIDB) which contains bibliographical data on reports for which hard copies are available (over 4,000); The Patent Data Base of worldwide patents of interest (over 260); the Journal Article Data Base which is self explanatory as to content; STANAG containing AC/310 developed test and requirement agreements and the Insensitive Munitions Points of Contact

(IMPOC) (over 400). This latter base contains a listing of individuals or laboratories having expertise in specific areas related to Insensitive Munitions related programs. These individuals and facilities have agreed to council the Pilot NIMIC staff as required to solve problem areas referred to the Pilot NIMIC.

Statistically Pilot NIMIC has reviewed over 14,000 citations for relevance to the data base and has entered over 5,700 into the data base system. Other documents await entrance into the system. Interestingly Pilot NIMIC has some 180 documents originating in non participating nations in the system. These have been either submitted by the originating nation or provided by a participating nation.

The subject matter in the data bases by type of information is as follows *(Vugraph 15):* The leading three categories are energetic materials, munitions, and detonics (DDT, XDT, etc.) with munition components, tests and trials, requirement statements, mitigation and fixes, platforms, accidents and cost benefits following in order. The first three subjects cover about 60% of the data available. The oldest documents in the system date back to 1969. However, about 35% are dated in the 70's and 54% in the 80's. Obviously input from the 90's is just commencing and much more data from the 80's is anticipated.

What is it that sets Pilot NIMIC apart from any of these documentation sources from which it has drawn or from efforts taking place under existing Data Exchange Agreements (DEA's) *(Vugraphs 16 & 17)*? The answer is that Pilot NIMIC performs an analysis function. This function is performed in two fashions: One in response to technical inquiries received from government and industrial agencies within a participating nation. These inquiries, if originated by a government agency are forwarded directly, if by industry via the national Focal Point, to Pilot NIMIC where the data base is examined and when coupled with the technical expertise of the staff a response is drafted. Since the achievement of all I.M. goals can seldom be achieved by the application of a single technology, often seemingly unrelated technologies are recommended together, (e.g. energetic materials and mechanical stress relief devices). The response often will deal with the synergistic effects of applying recommended design fixes, since indeed the environments of the full logistic life cycle must be considered in evaluating the true ability of design fixes to solve a stated problem. The expertise of the technical staff is often complemented by using the national experts identified in the IMPOC data base. Nowhere else in NATO or the western world does such a capability exist.

The second type of analysis performed by the staff involves a critical review of the data bases to identify gaps in the technology available and make recommendations to the participating nations which may lead to collaborative programs to fill the gap. Such collaboration will reduce the cost of R&D efforts as well as redundancy. Also resultant from such reviews will be state-of-the-art reports on specific technology areas which will provide comprehensive summaries of data on a specific technology topic. The state-of-the-art reports are published as developed and made available to participants.

Pilot NIMIC recognizes that its data base is in its infancy and therefore immature for providing in depth responses to some technical inquiries. This situation places added emphasis on the technical expertise of the staff and the ability to access information from the POC to provide meaningful responses. By the same token, since I.M. initiatives are relatively new, the I.M. policies and programs of many participating nations are in their infancy, a situation reflected in the essence of many inquiries and in the type of data submitted to Pilot NIMIC. As the concept of I.M. matures nationally so will the NIMIC data base mature, allowing the Center to respond to the more demanding inquiries certainly to be developed in future years. The success of NIMIC in providing quality responses to the needs of munition developers will always require the expertise of the technical staff to research the constantly increasing data base with respect to a given problem area.

As of 1 July 1990, 156 inquiries have been received and responses have been developed for 125 *(Vugraph 18)*. The three leading subject categories numerically are: energetic materials, munitions, detonics (SDT, XDT, etc.). Next in line are questions on munition components, requirements, tests and trials. The remaining subject categories in order are: mitigation and design fixes, platforms, accidents, and cost/benefit analyses. The frequency of receipt does not necessarily reflect the importance of a given subject category in the realm of I.M. programs as understood today. As a matter of fact one of the most significant subject categories in national I.M. policy making decisions is that of cost/benefit analyses. Obviously this topic is one of the more demanding to deal with on the part of the technical staff.

This stated immaturity of the Pilot NIMIC data base also hinders the ability of the staff to identify gaps in the technology which would be worthy of additional effort to remedy *(Vugraph 19)*. At present the staff is aware of certain areas requiring technical solutions but confirmation is required before a recommendation for action is appropriate. Confirmation will be possible with the growth of the data base. As an example of a potential area of deficiency is the availability of small scale tests to predict the outcome of full scale munitions to I.M. tests and trials. The costs in required hardware and personnel to perform full scale munitions tests limit the number of tests performed to a quantity representative of low statistical value. The capability to predict and validate the few full scale test results with data from small scale tests has not been achieved. Specific areas for added effort need to be identified.

A more readily identifiable data base problem is in determining gaps in the data base itself. Pilot NIMIC has made known gaps in its data base and has requested participants take action to search for and input data in specific areas such as: physical and thermal data for energetic materials and munition construction materials, Hugoniot and critical-diameter data on energetic materials.

Pilot NIMIC has developed and is currently developing state-of-the-art reports on the topics of *(Vugraph 20)*: Norwegian Multipurpose Ammunition; Methodology for I.M. Cost Benefit Analysis; LOVA Propellants; Thermal Stress as Related to Munitions. Pilot NIMIC also recognizes the need to develop synopsis papers on mechanical (impact) and shock stresses in relation to I.M. test requirements.

As has been stated, Pilot NIMIC began operations in May 1988 for a three year period. Based on an assessment of the ability of the Pilot NIMIC to perform the assigned tasks, a determination was to be made to proceed with the final phase, a permanent NIMIC to be located at NATO HQ in Brussels. A formal assessment report was drafted in April 1990 *(Vugraph 21)*. This report was provided to the participating nations for staffing. (Copies were also provided potential future participating nations for their review and comment).

At the June 1990 meeting of the AC/310 Main Group nations were polled relative to their "willingness to participate" in the NIMIC phase. All current participants indicated this willingness as did three other nations. Based on the results of this poll, AC/310 requested the Conference of National Armament Directors (CNAD) to approve the formation of NIMIC as a NATO Project Office. Given an affirmative reply by CNAD, a MOU governing NIMIC will be placed for signature before CNAD at their October 1990 meeting. Operation of NIMIC in Brussels would then commence 1 May 1991.

As one of the stated functions of Pilot NIMIC is to prepare for transition to NIMIC in Brussels, much recent effort has been given to this planned action *(Vugraph 22)*. Resultant from this effort some items of interest are:

- NIMIC Staff was Defined as:

Program Manager	A-5
Information Technician	A-3
Information Specialist	B-6
Secretary	B-3
(4) Technical Specialist	A-4

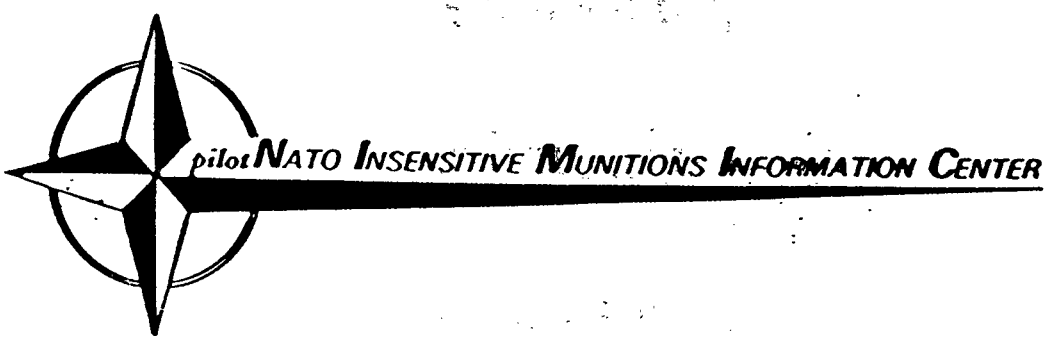
- Facility needs and availability at NATO HQ have been established.
- Administrative support is available from NATO International Staff and a Letter of Agreement has been developed.
- Funding is to be furnished by participants on share basis. Based on the relative size of the dispense budgets nations will provide either one or two shares.

All NIMIC positions will be filled by selectees under the NATO hiring procedures. The NIMIC Steering Committee will have influence in the final selection process particularly for the Program Manager and Technical Specialists. Technical Specialists will be required to have a broad experience in the field of munition design, acquisition, and use.

In conclusion, it is to be noted that Pilot NIMIC is a small international data base and likely will remain of moderate size even in the NIMIC phase. By virtue of its unique requirement to perform

data analyses in the field of I.M. and safety of munitions it stands apart from any other data base. After less than three years of operation, (the first portion of which involved many administrative tasks such as establishing the physical plant, drafting procedural and security guidelines, etc.), Pilot NIMIC has realized the goals assigned to it. It has also established the fact that the NIMIC concept is capable of providing the required assistance to munition developers to facilitate meeting the more stringent design requirements and thus improve the potential for munition interoperability within the alliance.

PILOT
NATO INSENSITIVE MUNITIONS INFORMATION CENTER
(NIMIC)



History

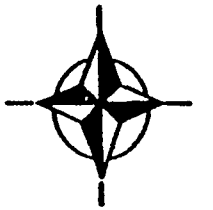
Oganization

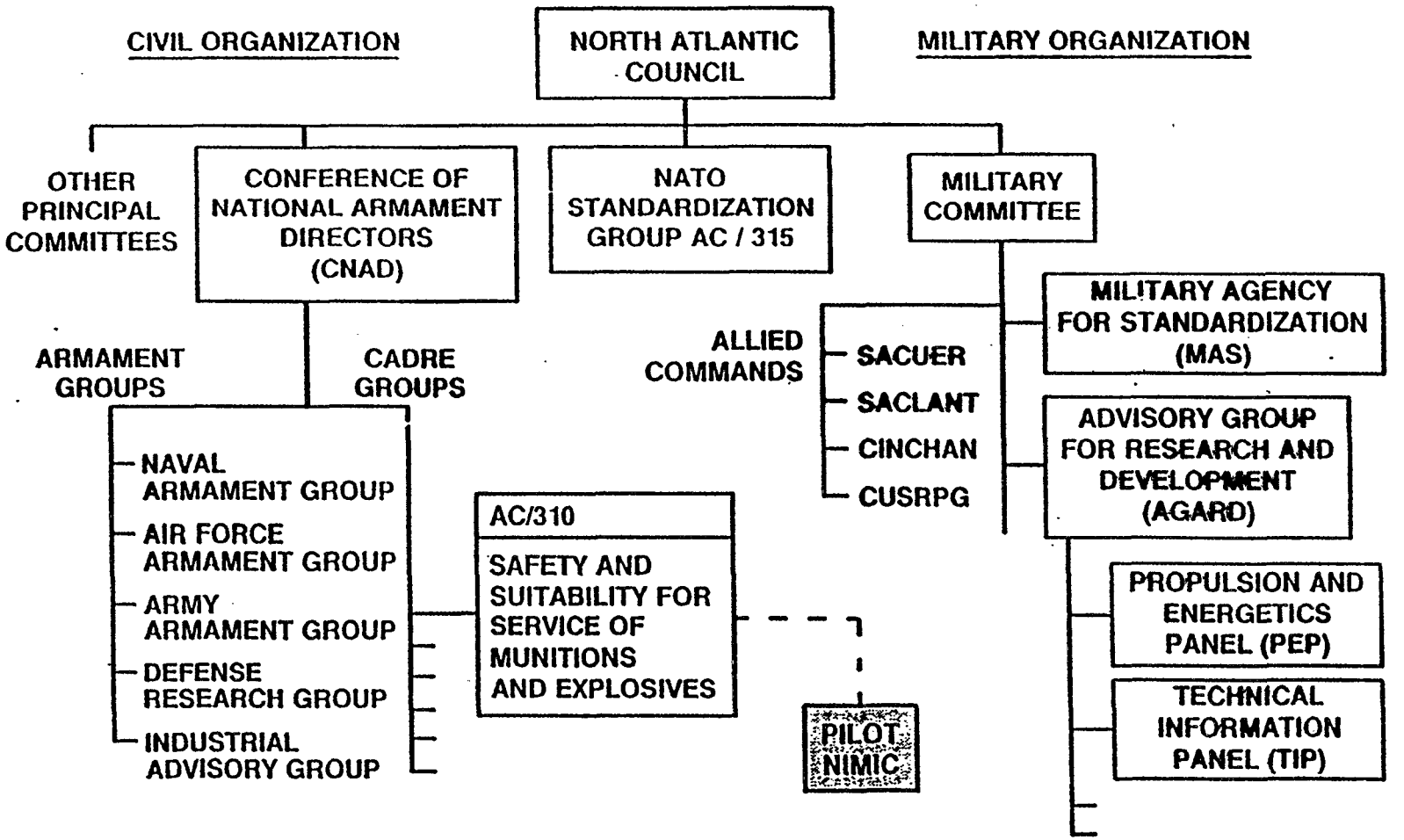
Operation

Assessment

Future

NATO





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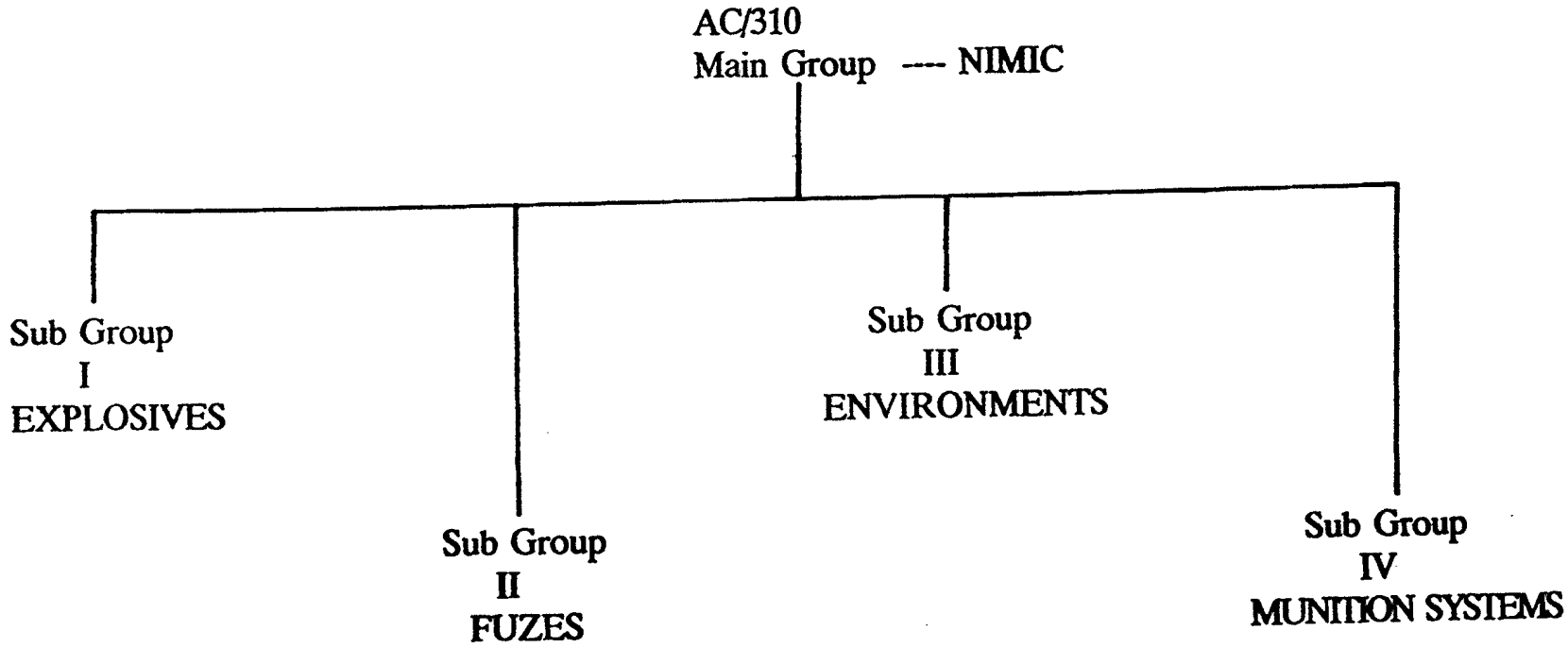
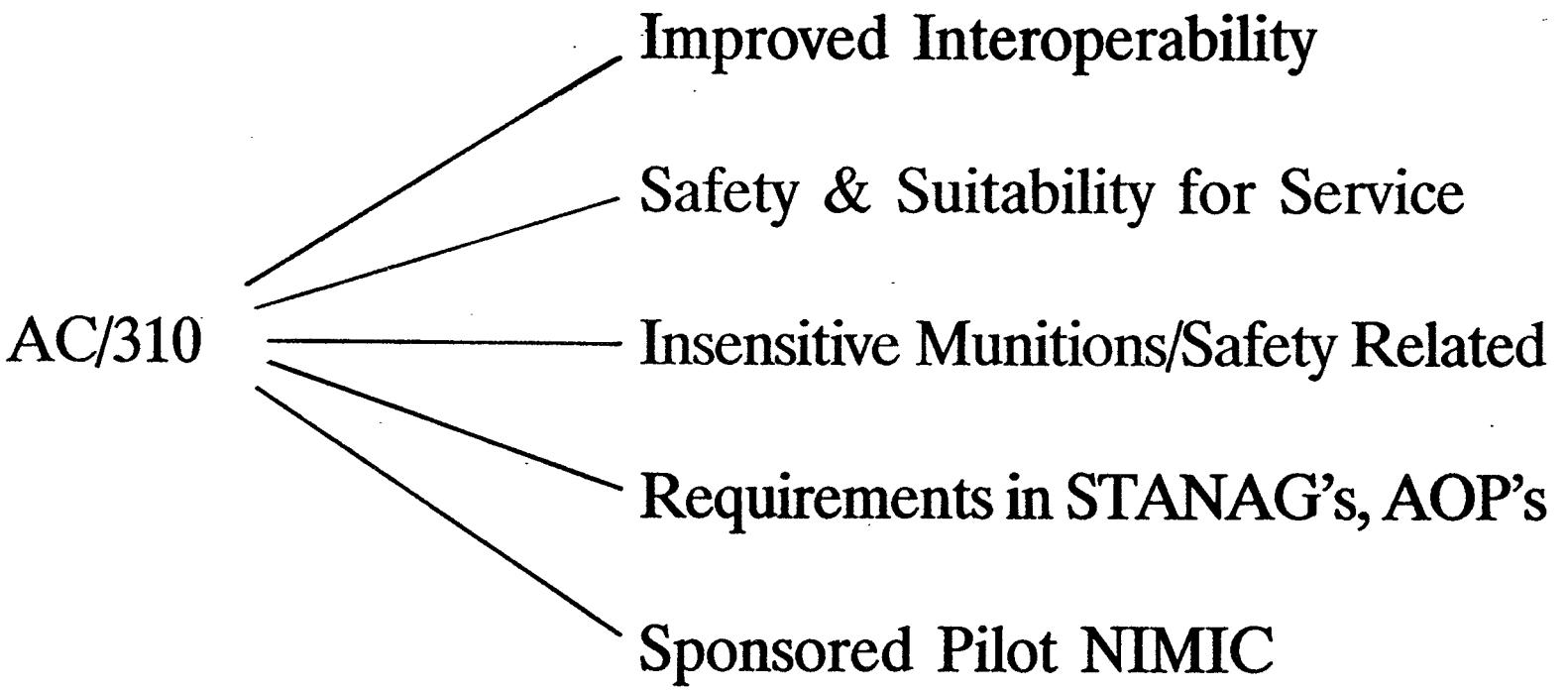

AC/310
Main Group --- NIMIC
Sub Group
I
EXPLOSIVES
Sub Group
II
FUZES
Sub Group
III
ENVIRONMENTS
Sub Group
IV
MUNITION SYSTEMS


AC/310
Improved Interoperability
Safety & Suitability for Service
Insensitive Munitions/Safety Related
Requirements in STANAG's, AOP's
Sponsored Pilot NIMIC

HISTORY

1983-84	Restricted Editorial Working Group
July 85	AC/310 Decision (Information Exchange Working Group)
October 86	Workshop
October 86	Information Center Working Group
April 88	MOU for Pilot NIMIC Operation in U.S.
April 88	Steering Committee
October 90	MOU for NIMIC
April 91	Operation in NATO HQ, Brussels

PILOT NIMIC

- Participating Nations - Canada, France, Netherlands, Norway, U.K., U.S.
- Host Nation - U.S.
  - Staff - Program Manager
    Information Technician
    Information Specialist
    Secretary
  - Facilities - Space, Supplies, Etc.
- Other Participants - Technical Experts (4)
- Steering Committee - Member from each Participant

Assigned Tasks (Pilot NIMIC):

1 - Collect, store and disseminate scientific and technical information on insensitive munitions (IM)

2 - Provide and maintain a comprehensive data collection so as to facilitate design efforts for IM and minimize the cost of research and development efforts

3 - Respond to technical enquiries by using the data collection to analyze and generate recommended design approaches/solutions for IM

4 - Identify technology deficiencies that prevent requirements from being achieved and make proposals for remedial action

5 - Analyze data provided to the pilot NIMIC and prepare data books and "state of the art" reports on IM

6 - Prepare plans and documentation for:

a) the establishment of a permanent NIMIC at NATO HQ
b) the transition of the Pilot NIMIC to NIMIC

AREAS OF CONCERN

• Combat Threats	-	Fragment Impact Bullet Impact Sympathetic Detonation Fire Etc.
• Explosives and Munitions	-	Rockets Missiles Bombs Fuzes Propellants Etc.
• Technical Areas	-	Ignition Thermal Explosions Detonation to Deflagration Transition (DDT) Mitigation Devices Etc.

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NATO AC/310
IEWP MEETING (9/85)

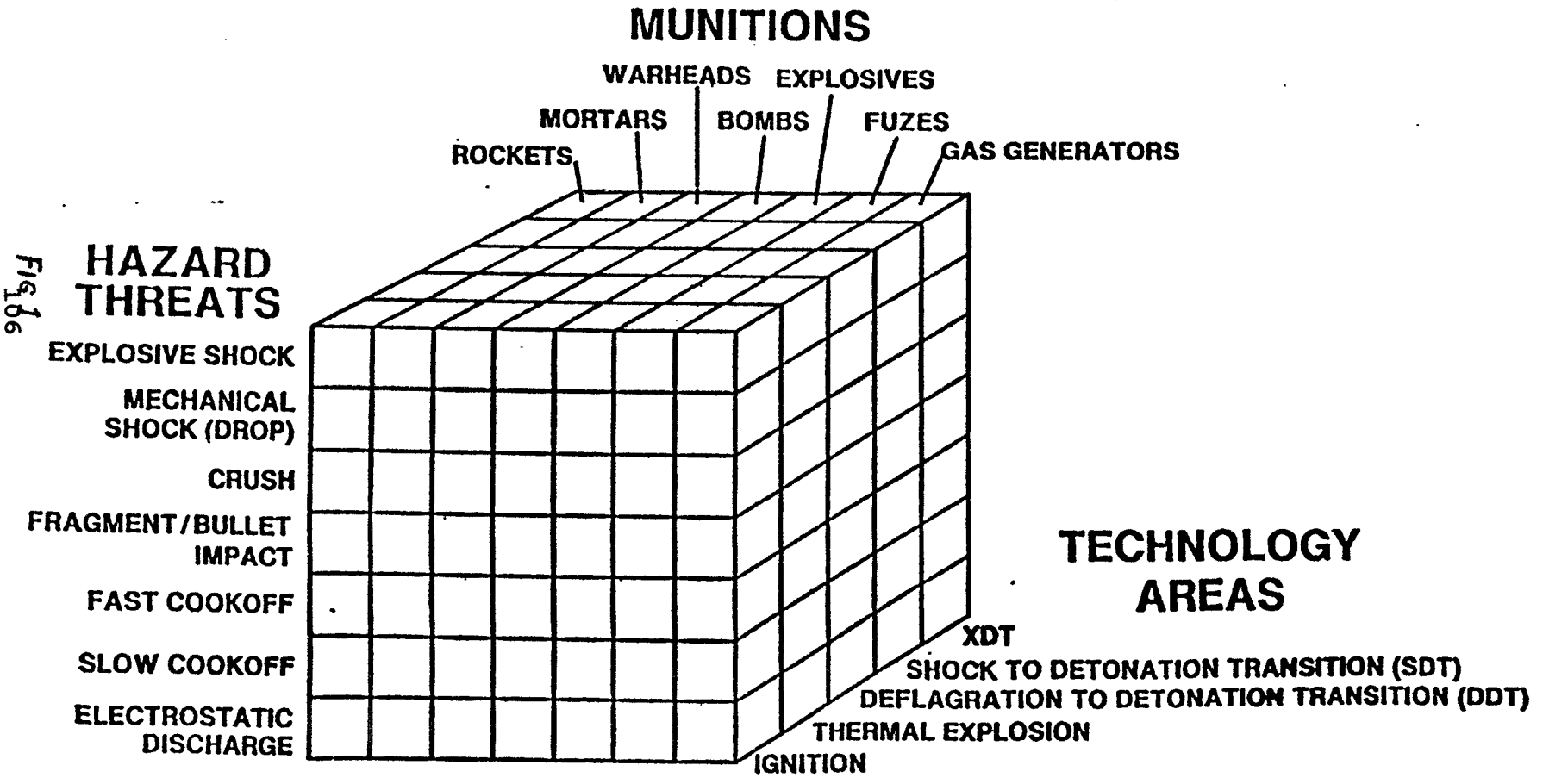

Fig 16

DEFINITION

Insensitive Munitions are those munitions which reliably fulfill their performance, readiness and operational requirements on demand, but which will minimize the violence of a reaction and subsequent collateral damage when subjected to unplanned stimuli.

TECHNOLOGY TERMS - MAIN AREAS OF INTEREST

BULLET IMPACT
BULLET IMPACT
BURNING
COOK OFF
DEFLAGRATION
DETONATION
DETONATIONS
DROP TESTS
ELECTROMAGNETIC RADIATION
ELECTROSTATIC CHARGE
ELECTROSTATIC FIELDS
ENERGETIC MATERIALS
EXPLOSIONS
FIRE SAFETY
FIRE HAZARDS
FIRE PROTECTION
FRAGMENT ATTACK
FRAGMENT IMPACT
FUEL FIRE
HAZARDS
IMPACT SHOCK
IMPACT SENSITIVITY
IMPACT TESTS
INSENSITIVE
LIQUID FUEL FIRE
LOVA (PROPELLANTS)
LOVUM (ROCKET MOTORS)
LOW VULNERABILITY
MULTIPLE FA
MULTIPLE BI
MULTIPLE BA
MULTIPLE FI
RATTAM (RESPONSE TO ATTACK OF AMMUNITION)
SAFETY
SENSITIVENESS
SENSITIVITY
SHOCK TESTS
SPALLATION
STORAGE MAGAZINES
SYMPATHETIC DETONATIONS
TRIPLE BASE (PROPELLANTS)

HIERARCHICAL LISTING OF HARDWARE TERM COVERAGE:

AMMUNITION COMPONENTS
. . Ammunition fragments
. . Bursting charges
. . Cartridge cases
. . . Combustible cartridge cases
. . Depth charge components
. . Explosive trains
. . . Boosters(explosives)
. . . . Mine boosters
. . . Delay elements (explosive)
. . . Explosives initiators
. . . . Detonators
. . . . . Electric detonators
. . . . Primers
. . . . . Electric primers
. . Firing mechanisms(ammunition)
. . . Arming devices
. . . Fuzes(ordnance)
. . . . Bomb fuzes
. . . . . Tail fuzes
. . . . Electric fuzes(ordnance)
. . . . Electromagnetic fuzes
. . . . . Infrared fuzes
. . . . . Optical fuzes
. . . . Exploders
. . . . . Torpedo exploders
. . . . Fuze functioning elements
. . . . . Arming devices
. . . . . Clock delay mechanisms
. . . . . Fuze setters
. . . . . Primer cups
. . . . Grenade fuzes
. . . . Guided missile fuzes
. . . . Impact fuzes
. . . . . Base detonating fuzes
. . . . . Point detonating fuzes
. . . . Mechanical fuzes
. . . . Mine fuzes
. . . . Miniature fuzes
. . . . Mortar fuzes
. . . . Nose fuzes
. . . . Point detonating fuzes
. . . . Point initiating fuzes
. . . . Projectile fuzes
. . . . Proximity fuzes
. . . . . Electrostatic fuzes
. . . . . Hydrostatic fuzes
. . . . . Magnetic fuzes
. . . . . Radio proximity fuzes
. . . . Rocket fuzes
. . . . Self destroying fuzes
. . . . Superquick fuzes
. . . . Time delay fuzes
. . . . Time fuzes
. . Powder bags
. . Projectile caps
. . Projectile cases
. . Rotating bands

AMMUNITION
. . Aircraft ammunition
. . Ammunition cases
. . Antiaircraft ammunition
. . Antiarmor ammunition
. . . Antitank ammunition
. . . Armor piercing ammunit.
. . Antimateriel ammunition
. . Antipersonnel ammunition
. . . Antipersonnel mines
. . . Canister projectiles
. . Antiship ammunition
. . . Antiship missiles
. . . Antisubmarine ammunit.
. . . . Antisubmarine missiles
. . . . Depth bombs
. . . . Depth charges
. . . Torpedoes
. . . . Acoustic torpedoes
. . . . Aircraft torpedoes
. . . . Antitorpedo torpedoes
. . . . Homing torpedoes
. . . . Quiet torpedoes
. . . . Torpedo components
. . . . . Torpedo exploders
. . . . . Torpedo motors
. . . . . Torpedo propellants
. . . . . Torpedo turbines
. . . . . Torpedo warheads
. . Artillery ammunition
. . Cartridges
. . . Cartridges(pad)
. . . Photoflash cartridges
. . Caseless ammunition

INFORMATION SOURCES

NTIS (U.S.) - National Technical Information Service

DTIC (U.S.) - Defense Technical Information Center

World Patent Index (U.S.)

DRIC (U.K.) - Defence Research Information Center

HSELine (U.K.) - Health and Safety Executive

DSIS (Canada) - Defence Scientific Information Service

CEDOCAR (France)

National Organizations/Laboratories/Industry

Major Data Bases

IMDB (I.M. Data Base)	=	Name given to function that allows simultaneous searching of NIDB, BRDB, FRDB, PTDB and JADB (see below). Soon to include database of Grey Literature.
NIDB (NIMIC Informational Data Base)	=	The main database which contains the bibliographies of technical reports concerning insensitive munitions, safety, testing, etc.. All documents reference have corresponding hard copy in our files.
STANAG (Standardization Agreements)	=	AC/310 Document Status INformation System. to date, 40 AC/310 STANAGS have been collected from various sources.
IMPOC (I.M. Points of Contact)	=	An address, telephone, fax and area of expertise listing of International experts (points of contact) & newsletter recipients.
PTDB (Patents Data Base)	=	Data base of IM relevant patents found by French Representative.
JADB (Journal Articles Data Base)	=	Data base of Journal Articles received as a consequence of searches made in Chemical Abstracts, etc.

Subject Matter in Pilot NIMIC

Energetic Materials	1748
Munitions	1149
Detonics (XDT, DDT, etc.)	1131
Munition Components	765
Tests and Trials	652
Requirements (IM and Safety	632
Mitigation and Fixes (for IM)	376
Platforms	258
Accidents	118
Cost-Benefit Analysis	14

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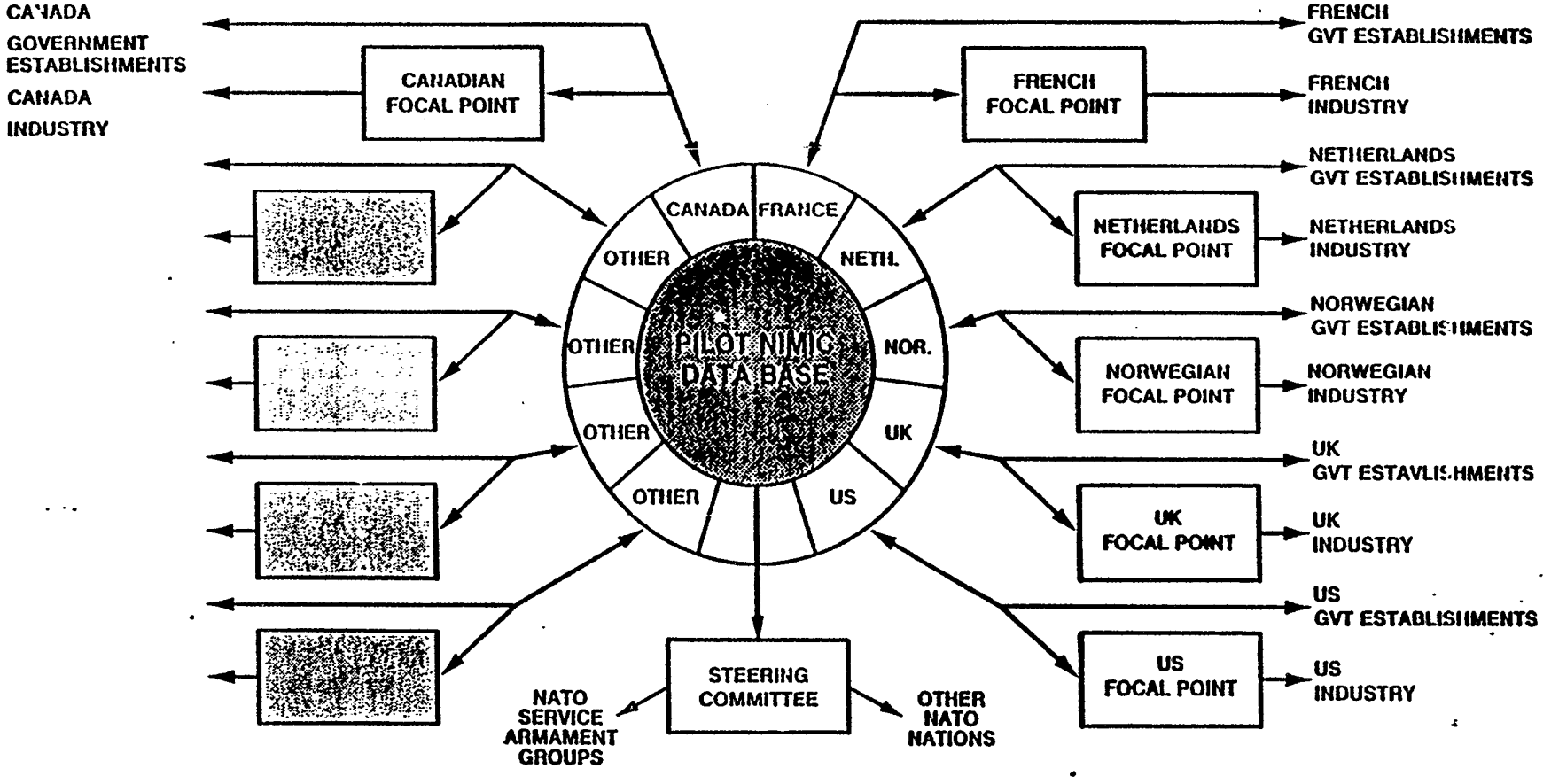
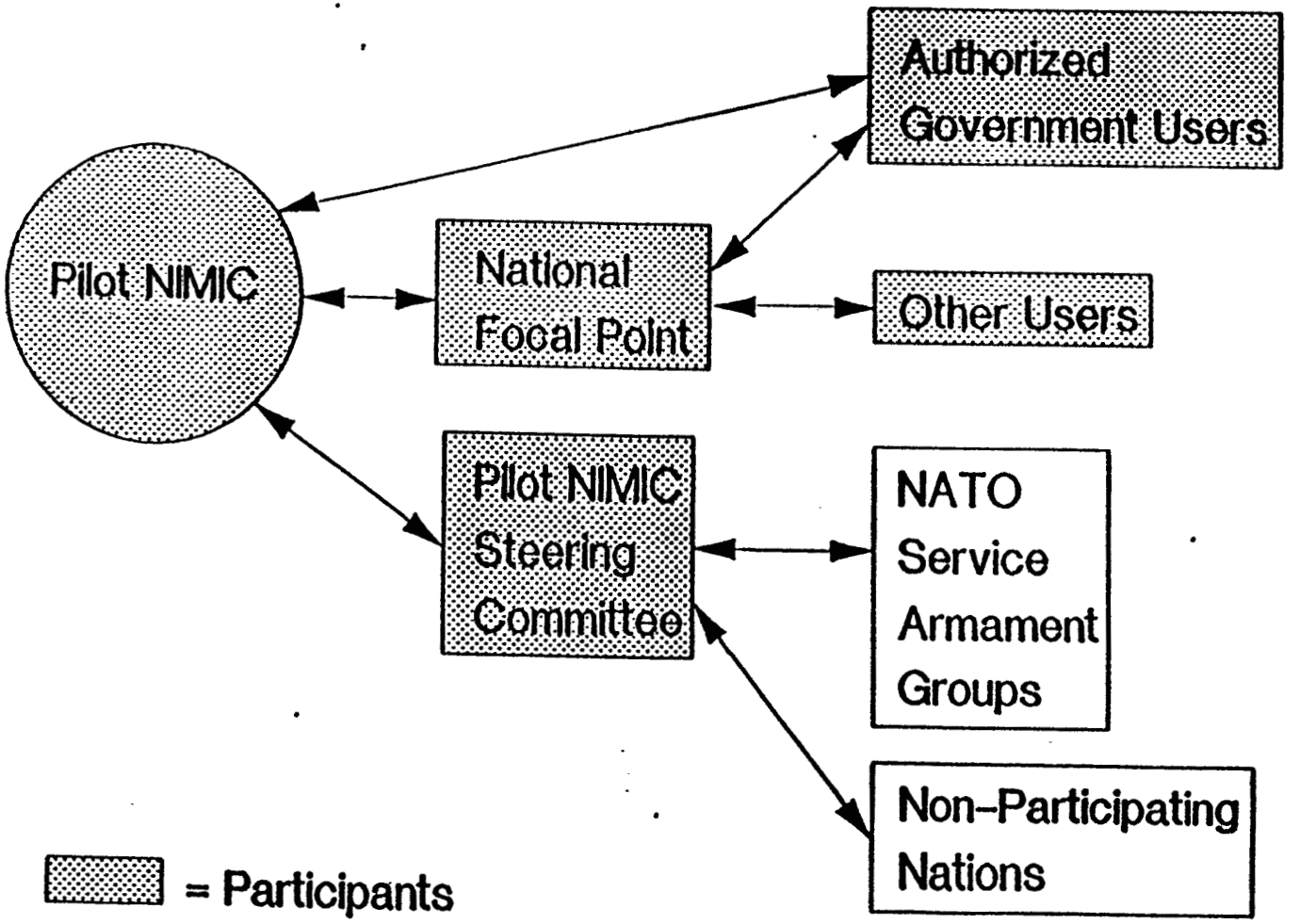
PILOT NIMIC



Using the Center



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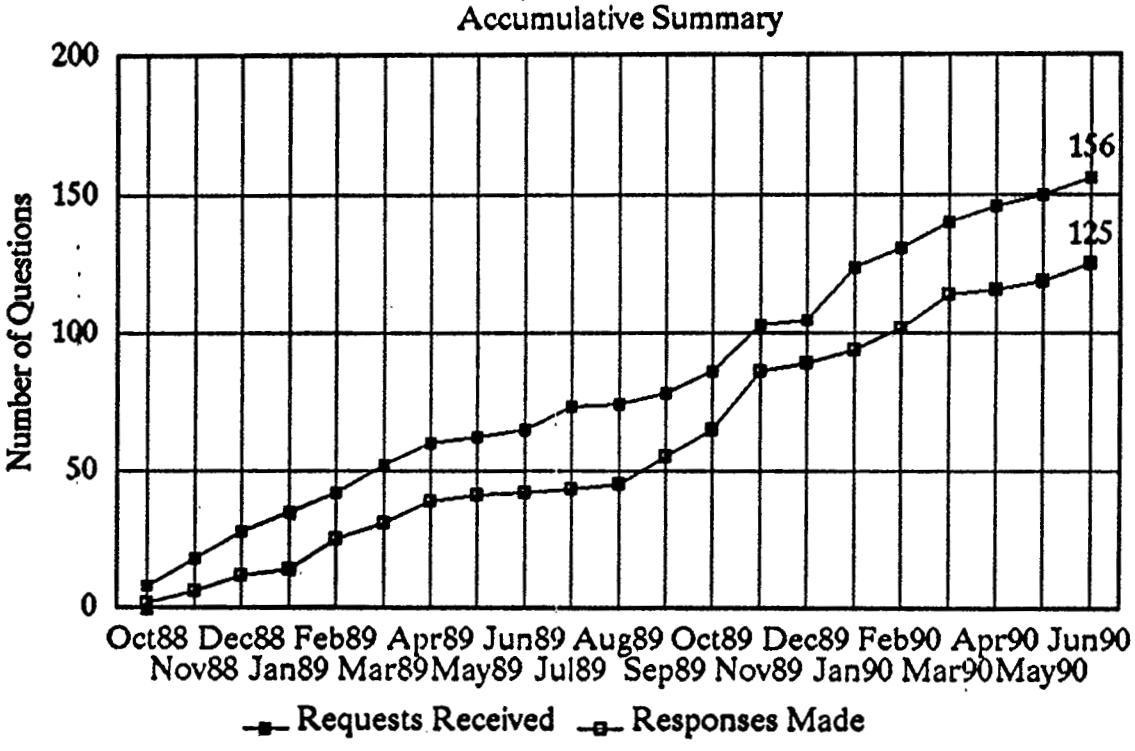
Pilot NIMIC Requests and Responses



Identification of Deficiencies

- DEFICIENCIES IN TECHNOLOGY
- DEFICIENCIES IN DATA BASE

State-of-the-Art Reports

- Norwegian Multipurpose Ammunition
- Methodology for I.M. Cost/Benefit Analysis
- LOVA Propellants
- Thermal Stress as Related to Munitions

SYNOPSIS
(Assessment Report)

Cumulative international experience arising out of major accidents in which munitions were involved has demonstrated the need to design weapons that are inherently less vulnerable to accidental or combat action stimuli. Weapons that meet specific criteria for reduced vulnerability are known as "insensitive munitions." As design technology for insensitive munitions evolves, it is desirable that it does so to the benefit of all the NATO community.

To meet the need of making information available to munitions designers, the concept of a NATO Insensitive Munitions Information Center (NIMIC) was conceived. The NIMIC concept provides a forum for technology information exchange that is intended to facilitate the efforts of munitions designers to satisfy the reduced vulnerability or "insensitive munitions"requirements.

In May 1988, a pilot NIMIC was established with the object of determining whether the NIMIC concept is viable. This report provides the evidence on which is based the conclusion that implementation of the NIMIC concept is capable of achieving the desired objective.

FUTURE

NIMIC - 1 May 1991

Facilities - At NATO Headquarters Building, Brussels, Belgium

Funding - By participating nations on a share basis

Staff - NATO Employees

Program Manager	A-5
Information Technician	A-3
Information Specialist	B-6
Secretary	B-3
(4) Technical Specialists	A-4

Administrative Support - NATO International Staff